

REMARKS

This Amendment responds to the Office Action dated February 18, 2004 in which the Examiner rejected claims 1-3, 5-6, 8-9, 11-12, 14-15 under 35 U.S.C. § 102(e) and rejected claims 4, 7, 10, 13 and 16-21 under 35 U.S.C. § 103.

Claims 1, 8 and 9 claim a method of patterning a thin film, method of manufacturing a thin film device and method of manufacturing a thin film magnetic head comprising the steps of forming an insulating organic film that is strippable by an organic solvent on a surface of a thin film to be patterned; forming a conductive film on the insulating organic film; forming a mask on the conductive film; patterning the thin film to be patterned by dry etching using the mask; and removing the conductive film and the mask by removing the insulating organic film using an organic solvent.

Through the method of the claimed invention forming an insulating organic film that is strippable on a surface of a thin film to be patterned, forming a conductive film on the insulating organic film and removing the conductive film and a mask by removing the insulating organic film using an organic solvent as claimed in claims 1, 8 and 9, the claimed invention easily removes a conductive film used to prevent the thin film that is patterned from breaking down by electrostatic charge due to irradiation of EB without damaging the thin film surface by etching. The prior art does not show, teach or suggest the invention as claimed in claims 1, 8 and 9.

Claim 16 claims a method of patterning a thin film, claim 20 claims a method of manufacturing a thin film device and claim 21 claims a method of manufacturing a thin film magnetic head comprising the steps of forming at least an insulating organic film that is strippable by an organic solvent and a conductive film on a surface of a

thin film to be patterned; forming a resist film on the conductive film; patterning the resist film using an electron beam writing method; patterning the thin film to be patterned by dry etching using the patterned resist film as a mask; and removing the conductive film and the mask by removing the at least insulating organic film using an organic solvent.

Through the method of the claimed invention forming at least an insulating organic film and conductive film on the surface of a thin film to be patterned, patterning a resist film using electron beam writing method and removing a conductive film and a mask by removing the at least insulating organic film using an organic solvent, as claimed in claims 16, 20 and 21, the claimed invention easily removes a conductive film adapted to prevent the thin film from breaking down by electrostatic charge due to irradiation by EB without damaging the thin film surface by etching. The prior art does not show, teach or suggest the invention as claimed in claims 16, 20 and 21.

As indicated above, the claims have been amended to make explicit what is implicit in the claims. Applicant respectfully submits that the amendment is unrelated to a statutory requirement for patentability.

Claims 1-3, 5-6, 8-9, 11-12 and 14-15 were rejected under 35 U.S.C. § 102(e) as being anticipated by *Reinberg et al.* (U.S. Patent No. 6,087,270).

Reinberg et al. appears to disclose methods of patterning substrates, particularly in semiconductor wafer fabrication. (col. 1, lines 4-5) FIG. 3 illustrates a semiconductor wafer fragment 10a comprising a bulk monocrystalline silicon substrate 12 having conductive features 14 formed thereover. An insulating dielectric layer 16 is provided over features 14, and in this example is provided with a

substantially planar outer surface. Referring to FIG. 4, an electrically conductive etch mask layer 18a is formed over layer 16 to a first thickness. (col. 3, lines 37-44)

An intermediate masking layer 20 is formed over layer 18a, followed by formation and patterning of a resist layer 22 over intermediate layer 20. (col. 4, lines 10-12)

Openings 24 are formed in resist layer 22. (col. 4, lines 20-22) Referring to FIG. 5, etching is conducted through intermediate hard mask layer 20 and ultimately into conductive etch mask layer 18a through openings 24 formed in resist layer 22. As shown, such etching is preferably conducted to etch openings 24 completely through layers 20 and 18a, and preferably selectively relative to interlevel dielectric layer 16. (col. 4, lines 25-31)

Referring to FIG. 6, substrate layer 16 beneath electrically conductive layer 18a is etched through openings 24 formed in layer 18, preferably at least in part by essentially continuing the preferred dry etching described above.

Referring to FIG. 7, electrically conductive layer 18a and hard mask layer 20 are removed from the substrate. Resist layer 22 of course has been previously removed. (col. 4, lines 53-59)

Thus, *Reinberg et al.* merely discloses a conductive feature formed directly on a substrate 12. Nothing in *Reinberg et al.* shows, teaches or suggests forming an insulating organic film that is strippable on a surface of a thin film to be patterned and then forming a conductive film thereon as claimed in claims 1, 8 and 9. Rather, *Reinberg et al.* merely discloses forming a conductive feature directly on a substrate 12.

Additionally, *Reinberg et al.* merely discloses removing the electrically conductive layer 18a and hard mask 20 from the substrate. Nothing in *Reinberg et al.* shows, teaches or suggests removing the conductive film and mask by removing

the insulating organic film using an organic solvent as claimed in claims 1, 8 and 9. Rather, *Reinberg et al.* merely discloses that the conductive layer and substrate surface are patterned by dry etching using the mask layer 20 as a mask.

Since nothing in *Reinberg et al.* shows, teaches or suggests forming an insulating organic film on a surface of the thin film to be patterned, forming a conductive film on the insulating organic film and removing the conductive film and mask by removing the insulating organic film using an organic solvent as claimed in claims 1, 8 and 9, Applicant respectfully requests the Examiner withdraws the rejection to claims 1, 8 and 9 under 35 U.S.C. § 102(e).

Claims 2-3, 5-6 depend from claim 1 and recite additional features. Applicant respectfully submit claims 2-3 and 5-6 would not be anticipated under 35 U.S.C. § 102(e) at least for the reasons as set forth above. Therefore, Applicant respectfully requests the Examiner withdraws the rejection to the claims under 35 U.S.C. § 102(e).

Claims 4, 10 and 16-21 were rejected under 35 U.S.C. § 103 as being unpatentable over *Reinberg et al.* and further in view of *Rika* (Japanese Reference 07-74076).

As discussed above, *Reinberg et al.* merely discloses forming a conductive etch mask layer 18a directly on a substrate surface to be patterned. Nothing in *Reinberg et al.* shows, teaches or suggests forming an insulating organic film and a conductive film on a surface of a thin film to be patterned as claimed in claims 16, 20 and 21. Rather, *Reinberg et al.* merely discloses directly forming the conductive etch mask layer 18a on the substrate surface.

Additionally, *Reinberg et al.* merely discloses patterning a hard mask layer 20 by dry etching using a resist pattern 22 as a mask. Nothing in *Reinberg et al.* shows, teaches or suggests a resist film is patterned using an electron beam writing method as claimed in claims 16, 20 and 21. Rather, *Reinberg et al.* merely discloses patterning a hard mask layer 20 by dry etching using a resist pattern 22 as a mask.

Finally, *Reinberg et al.* merely discloses that the conductive layer 18a and the substrate surface are patterned by dry etching using the pattern hard mask layer 20 as a mask. Nothing in *Reinberg et al.* shows, teaches or suggests a conductive film and mask are removed by removing an insulating organic film using an organic solvent as claimed in claims 16, 20 and 21. Rather, *Reinberg et al.* merely discloses patterning the conductive layer 18a and substrate surface by dry etching using the hard mask layer 20 as a mask.

Rika appears to disclose a resist film 100 applicable to electron beam exposure has a double structure where an electrification prevention film 12 and fluorine plastic resin film 13 are laminated on a target 11 to be machined. Namely, the electrification prevention film 12 is a conductive film and consists of, for example, amorphous carbon film, and has a resistivity of $2 \times 10^{-6} [\Omega \cdot \text{cm}]$. The fluorine plastic film 13 is a film which reacts with electron rays. The amorphous carbon film 12 is formed by the sputter method. Therefore, when electron beams which are formed by an aperture 101 irradiate the resist film 100, electrons reaching the irradiated region destroy the fluorine plastic resin film 13 and at the same time the irradiated electrons are spread into the electrification prevention film 12, and charge-up is suppressed, thus preventing the beam position deviation phenomenon of electron beams.

Thus, *Rika* merely discloses forming a carbon film 12 on a substrate 11. Nothing in *Rika* shows, teaches or suggests forming an insulating organic film and conductive film on the surface of a thin film to be patterned as claimed in claims 16, 20 and 21. Rather, *Rika* merely discloses directly forming a carbon film 12 on a substrate and then forming a resin film 13 on the carbon film 12 as a resist film.

Additionally, *Rika* merely discloses patterning the substrate 11 by selectively etching using a mask 13. Nothing in *Rika* shows, teaches or suggests removing a conductive film and mask by removing an insulating organic film using an organic solvent as claimed in claims 16, 20 and 21. Rather, *Rika* merely discloses patterning a substrate 11 by selectively etching using a mask 13.

Since neither *Reinberg et al.* or *Rika* show, teach or suggest forming an insulating organic film and conductive film on a surface of a thin film to be patterned and removing the conductive film and a mask by removing the insulating organic film using an organic solvent as claimed in claims 16, 20 and 21, Applicant respectfully requests the Examiner withdraws the rejection to claims 16 and 20-21 under 35 U.S.C. § 103.

Claim 4 depends from claim 1 and recites additional features. Applicant respectfully submits that claim 4 would not have been obvious within the meaning of 35 U.S.C. § 103 over *Reinberg et al.* and *Rika* at least for the reasons as set forth above. Therefore, Applicant respectfully requests the Examiner withdraws the rejection to claim 4 under 35 U.S.C. § 103.

Claims 7, 13 and 19 were rejected under 35 U.S.C. § 103 as being unpatentable over *Reinberg et al.*

Applicant respectfully traverses the Examiner's rejection of the claims under 35 U.S.C. § 103. The claims have been reviewed in light of the Office Action, and for reasons which will be set forth below, Applicant respectfully requests the Examiner withdraws the rejection to the claims and allows the claims to issue.

As discussed above, since nothing in *Reinberg et al.* shows, teaches or suggests the primary features as claimed in claims 1 and 16, Applicant respectfully submits that the claims would not have been obvious within the meaning of 35 U.S.C. § 103 over *Reinberg et al.* Therefore, Applicant respectfully requests the Examiner withdraws the rejection to claims 7 and 19 under 35 U.S.C. § 103.

The prior art of record, which is not relied upon, is acknowledged. The references taken singularly or in combination do not anticipate or make obvious the claimed invention.

Thus it now appears that the application is in condition for reconsideration and allowance. Reconsideration and allowance at an early date are respectfully requested.

If for any reason the Examiner feels that the application is not now in condition for allowance, the Examiner is requested to contact, by telephone, the applicant's undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed within the currently set shortened statutory period, applicant respectfully petitions for an appropriate extension of time. The fees for such extension of time may be charged to our Deposit Account No. 02-4800.

In the event that any additional fees are due with this paper, please charge
our Deposit Account No. 02-4800.

Respectfully submitted,

BURNS, DOANE, SWECKER & MATHIS, L.L.P.

Date: May 18, 2004

By:

A handwritten signature in black ink, appearing to read 'EMAS', written over a horizontal line.

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